**Figure Captions**

**Supplementary Data**

Supplemental Figure 1. Lift-out schematic for TEM sample preparation.

(A) Gallium ion image of enamel “pearls.” Following deposition of a platinum strap (not shown), scanning electron images show (B) trenches that were milled on both sides of the region of interest and (C) the removal of the specimen from the surface using a nanomanipulator welded with FIB-deposited platinum. (D) Finally, the TEM sample was welded to a copper half TEM grid and thinned using low energy gallium ions for imaging and analysis.

Supplemental Figure 2. The ultrastructure of authentic enamel.

(A) The enamel ultrastructure exhibits rods consisting of aligned bundles of thin crystallites. (B) Selected area electron diffraction of the image in (A) indicates that the material is made of hydroxyapatite with texture along the c-axis in the direction of the rod. 1: (002), 2: (004), 3: (211), 4: (310). (C) A representative EDS spectrum showing that the authentic enamel is composed of calcium and phosphorus, as expected. The copper X-ray emission lines are due to the copper grid on which the sample was mounted.